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NUCLEAR PROPULSION SYMPOSIUM

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REAR ADMIRAL CHESTER WARD
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Nuclear propulsion—if we exploit it neither too little nor too late—can secure the survival of the United States. It provides vast new capabilities in mobility and concealment for Polaris submarines, which can best contribute invulnerable deterrence of general war. Nuclear propelled carriers, cruisers and destroyers, soon to join our surface fleets in appropriate balance, will add new dimensions of endurance, mobility and independence of foreign bases.

New legal frontiers must be opened to encourage maximum development in the minimum time period of this new asset for the Navy. This Symposium reveals surprising depth and complexity in the legal problems which we must and will solve to support our growing nuclear fleets. Officers of the U.S. Navy, as pioneers in operation of nuclear-powered ships, have a need to know these problems.

SOME LEGAL IMPLICATIONS IN THE OPERATION OF NUCLEAR-POWERED SHIPS

By SENATOR HENRY M. JACKSON*

THE GROWING USES of atomic energy have brought many new problems to the lawyer and the legislator as well as the scientist, the engineer, and the sailor. One of the first applications of nuclear fission was in ship propulsion, and it is perhaps ironic that the legal problems associated with the operation of nuclear-powered ships have never been thoroughly explored. Two comprehensive legal studies have been sponsored by the Atomic Industrial Forum on atomic energy liability problems—one by the Columbia Law School and one by the Harvard Law School—but both have expressly postponed consideration of nuclear ship indemnity questions. The legal periodicals abound with learned articles concerning atomic energy problems, but they are almost unanimously unconcerned with the sea. On the international front, the Euratom and OEEC countries have, after long consultations, drafted an atomic energy liability convention. Here again, however, the maritime aspects have been specifically avoided as not worthy of separate consideration at this time.

For these reasons I am especially glad to make this contribution to the U.S. Navy JAG Journal. I think it is entirely fitting that the Navy, which has led the way technically in nuclear ship propulsion, should lead also in exploring unchartered legal seas. Answers will not come readily, but it is time to start the search and pose the questions for further research, analysis and resolution, in the tried and true manner of the accomplished lawyer. Let us hope that we will have as much success as our nuclear engineer colleagues!

LEGAL QUESTIONS

WE CAN READILY identify many legal questions arising out of the operation of nuclear-powered ships: Are special duties and responsibilities placed upon the nuclear ship operator because of the possible catastrophic consequences of radioactive particles escaping from the ship reactor in the remote chance of a very serious mishap? Are special rules of the road required for nuclear-powered ships? Is the operator using a "dangerous instrumentality", making him subject to liability without fault? Should the rule of *Rylands v. Fletcher* (A rule of negligence concerning a "dangerous instrumentality".) be extended to nuclear ships? What is the liability of a manufacturer who supplies reactor parts under the rule of *MacPherson v. Buick Motor Co.?* (a rule concerning the liability of the manufacturer) Should the ancient maritime rules limiting the liability of the ship owner be applicable to nuclear ships? And can one nation bring nuclear ships bearing its flag into the port of another nation under existing agreements, or are special agreements necessary for the high seas and foreign ports? These are only some of the questions. I am sure that the Navy lawyers—more expert than I in the ways and the life of the sea—can and will pose many more.

These are all new questions—thanks to our atomic age. I understand that some of them

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In this article, Senator Jackson, as a lawyer and legislator, and particularly as a member of the Joint Committee on Atomic Energy, writes of some of the new legal problems associated with operations of nuclear-powered ships.

will be treated elsewhere in this edition, and I will discuss primarily the knotty problem of third party liability associated with atomic hazards.

NUCLEAR LIABILITY PROBLEMS

THIS PROBLEM ARISES because of the possibility, remote as it may be, of a catastrophe resulting in the release from a reactor of millions of fission products in a populated area, possibly causing many millions or billions of dollars of damage.

In 1956 the Joint Committee on Atomic Energy held hearings on third party liability problems for land-based power reactors. At that time we asked the Atomic Energy Commission, the insurance, reactor, and utility industries, to give further study to the problems, and to plan to appear again before the Committee the following year. In 1957, the AEC submitted a report prepared by scientists at Brookhaven National Laboratory which attempted to estimate the maximum credible damage if a 500,000 KW (thermal) reactor should have an accident after 180 days of operation (sufficient to build up fission products) in a crowded area, under the worst imaginable circumstances. Admiral Strauss, the then Chairman of the AEC, testified before the Committee on March 25, 1957, as follows:

> "For the three types of assumed accidents, the theoretical estimates indicated that personal damage might range from a lower limit of none injured or killed to an upper limit, in the worst case, of about 3,400 killed and about 43,000 injured. . . . Hypothetical property damages range from a lower limit in the worst imaginable case of about $7 billion. This latter figure is largely due to assumed contamination of land with fission products. . . ." [1]

To my knowledge no similar study by experts has been made to determine the maximum credible damage if a serious ship reactor accident should occur in a crowded port. Such a study might be valuable in order to assess legal and policy questions on liability—not to scare people to death.

Our country has had a very successful safety record in operating nuclear reactors, and quoting again from the testimony of Admiral Strauss:

> "Nuclear reactors have been operated in the United States since December 2, 1942, with a safety record better than that of other industry. More than 100 reactor years of regular operating experience have been accumulated, including experience with reactors of high power and large inventories of fission products, without a single personal injury and no significant deposition of radioactivity outside of the plant area. There have been a few accidents with research reactor installations as contrasted with the perfect record of safety of the regularly operating reactors. But even these accidents with research and experimental reactors did not affect the public."

THE SKATE INCIDENT

THE U.S. NAVY has, of course, led the way in reactor operation, and has demonstrated dramatically that ship reactors, in particular, can be operated safely. In spite of this record, on August 21, 1958, the Submarine SKATE, after a successful voyage under the polar ice-cap, was refused admittance to the harbor of Copenhagen by our good friends and allies, the Danes. Premier Hansen was reported in the papers to have said:

> "In case of an accident, there would be a risk, and under these circumstances, the Government has decided to cancel the visit."

This incident posed, for the first time, many international problems of nuclear shipping. How should we treat nuclear ships? Do they require special ports, special rules? It is time for lawyers, engineers, and maritime experts to go to work on the development of acceptable international rules.

Thus we must approach realistically that troublesome legal problem of the remote possibility of an atomic catastrophe, with thousands of claims and possible liabilities in the hundreds of millions—or even billions—of dollars. What has been done to date?

PRICE–ANDERSON ACT

IN 1957, THE Congress enacted the Price-Anderson Act (applying to shore based reactors in the U.S.). In 1958 this act was extended to cover the operations of the NS SAVANNAH, our first nuclear-powered merchant ship.[3]

The Price-Anderson Act, PL 85–256, amended the Atomic Energy Act of 1954 to provide a method for handling third party liability claims in the event of an atomic catastrophe. The Act requires reactor operators, or facility licensees, to obtain private liability insurance or another

1. Hearings before the Joint Committee on Atomic Energy Congress of the United States, Eighty-fifth Congress, first session, on *"Governmental Indemnity and Reactor Safety,"* p. 11.

2. As an amendment to the Atomic Energy Act of 1954, principally as Section 170 of that Act.

3. The SAVANNAH is a 10,000-ton combination cargo-passenger ship, now under construction in Camden, N.J., scheduled for launching in May, 1959, with start-up and test operation scheduled for early 1960. She will be 595½ feet long, have a 78-foot beam, and a plant of 22,000 shaft horsepower.

form of "financial protection" up to the amount determined by AEC, or the maximum amount available from private nuclear indemnity pools, currently $50–$60 million. Above this amount, a governmental indemnity of $500 million is made available, at a token charge to the licensee, and a procedure is established limiting the liability of the licensee and prorating claims.

Thus if an atomic catastrophe should result in $1 billion liability, $50–$60 million would be available from the licensee's insurance, $500 million from the government, and the claims would be prorated accordingly, unless Congress should enact special supplementary relief after the catastrophe, as in the Texas City incident. In this way the Act provides a statutory method of protecting the reactor licensee and manufacturers from liability problems which might have deterred atomic energy development.

During consideration of this legislation much was said about "protecting the public". Of course, property damage to members of the public can usually be fairly compensated in money; but death and personal injuries are quite a different thing. The only real protection against this type of loss is safety—and for this reason the Joint Committee wrote special provisions into the bill emphasising safety considerations. These provisions include requirements for public hearings and public reports by the Advisory Committee on Reactor Safeguards in connection with all major reactor license applications.

In 1958, the Joint Committee on Atomic Energy considered proposed bills to provide governmental indemnity for the NS SAVANNAH. The need for this legislation was stated as follows by Mr. Richard Godwin, Chief of the Maritime Branch of the AEC Division of Reactor Development:

> "Even though the proposed operation of the nuclear ship Savannah is 2 years away, it is important to recognize the need for immediate legislation to permit the planning for the operation of the nuclear ship Savannah in foreign territorial waters. Initial informal discussions with certain foreign governments lead to the conclusion that an understanding of the position of the United States with respect to the financial protection to be extended to foreign nationals will be a prerequisite to any agreement for the entry of the Savannah into foreign ports."[4]

Two principal problems confronted the Committee: the amount of governmental indemnity to be provided and the agency to administer the indemnity contracts. The original bill, S. 3106, introduced by my colleague from Washington, Senator Magnuson, provided an "open end" indemnity, and placed administrative responsibility in the Maritime Administration, Department of Commerce. A subsequent bill introduced by Congressman Mel Price of the Joint Committee, provided for a $50 million governmental indemnity, and responsibility in the AEC. After two days of hearings, and due deliberation within the Committee, it was finally decided to recommend that Congress authorize $500 million governmental indemnity for the SAVANNAH, and place responsibility in the AEC, which had already promulgated regulations and established procedures and know-how on the indemnity problem. Thus, by adding a new subsection 170–1, the SAVANNAH was brought under the coverage of the indemnity provisions of the Atomic Energy Act. However, the bill was expressly limited to the SAVANNAH, and new consideration will have to be given to the indemnity problems of any future nuclear maritime ship.

4. See hearings before the Joint Committee on Atomic Energy on "Operation of AEC Indemnity Act," p. 111, July 17, 1958.

PROPOSED DEFENSE AND SPACE INDEMNITY BILLS

INDEMNITY LEGISLATION HAS also been requested by the Defense Department and the new Space Agency. Both of these proposed bills were patterned after the Atomic Energy Indemnity Amendments, PL 85–256, described above. In his letter of February 2, 1959, forwarding the proposed bill, Secretary McElroy spoke as follows:

> "There is forwarded herewith a draft of legislation 'To authorize the Department of Defense to indemnify its contractors against nuclear and other unusually hazardous risks, to limit the liability of contractors so indemnified, and for other purposes.'
>
> "The purpose of the proposed legislation is to grant to the Department of Defense for a temporary period specific statutory authority to indemnify its contractors against risks defined by the contract as unusually hazardous.
>
> "The proposed legislation would authorize indemnification only to the extent not compensated for by insurance or otherwise.
>
> ". . . Similar to the indemnification authority for the Atomic Energy Commission enacted as Public Law 85–256, the Government's obligation to all indemnified parties is restricted to $500 million per incident, and the liability of the parties indemnified to third persons is also so limited.
>
> "The present situation appears to present an urgent need for such legislation as this. Contractors in extra-hazardous fields are hesitant about contracting with the Government, because of the risk that unexpected accidents in this type of activity might cause

them enormous liabilities and losses. Against this possibility no adequate insurance is now available, as indicated above. Only by assumption of this extra risk can the Government assure itself of a continuing willingness of defense contractors to participate in such projects."

The Defense bill has been introduced in the House as H.R. 4103. I cannot predict the outcome of these bills, but it seems likely that industry will turn increasingly to the Federal Government for indemnity against "unusually hazardous risks."

FOREIGN ATOMIC LIABILITY DEVELOPMENTS

NOW, LET US look abroad, especially to Western Europe, to see whether those countries which are developing atomic energy have wrestled with liability problems. Large scale reactors have been constructed in Russia (where private liability claims against state owned and operated reactors are presumably not encouraged), and in England. But there again, most power reactors are government owned, and fewer liability problems are presented to the government operator than would confront a private operator. However, the United Kingdom Atomic Energy Authority has recently forwarded to the Joint Committee a copy of the Nuclear Installations Bill. It has passed the House of Lords and was schedule to be introduced for its Second Reading in the House of Commons on February 2, 1959. This bill, as amended in Committee and on Re-Commitment, is "to make provision for the regulation of certain installations capable of emitting ionising radiations and with respect to the incidence of and the provision of cover for, liability in respect of any such radiations emitted from, or in connection with the use of, any such installation. . . ."

The U.K. bill is somewhat similar to our Atomic Energy Act in that it provides procedures for the licensing and inspection of privately owned reactors, and places upon the licensee certain duties to assure safety to the public. However, as to its indemnity features, it provides only (in subsection 4(1)) that the licensee shall "make such provision, either by insurance or some other means . . . to ensure that any claims in connection with the use of the site . . . duly established . . . caused by ionizing radiations . . . are satisfied up to an aggregate amount of five million pounds. . . ." Moreover, it provides (in subsection 3(5)) that the liability of the licensee under the bill shall be "in substitution of any liability of the balance apart from the subsection in respect of any ionizing radiation." Most interesting of all, for our purposes, it expressly provides that certain provisions of other Acts (relating to bringing of actions in rem against ships or aircraft), and section 203 of the Merchant Shipping Act, 1894, (which relates to the limitation of the liability of shipowners), shall not apply to claims under the bill.

The U.K. bill seems to me interesting for at least two reasons:

First, it apparently provides an advance total pool of only five million pounds (less than $15 million) from private insurance sources for liability claims, with no additional governmental indemnity, as compared with the USA total pool of $50–$60 million from private insurance, *plus* a $500 million governmental indemnity. However, the U.K. bill does expressly provide (in subsection 4 (3)):

> "If, in consequence of any occurrence . . . is likely to exceed five million pounds, he shall by order certify accordingly, and any such order shall be made by statutory instrument and be laid before Parliament after being made . . ."

Thus the British have apparently decided to depend upon governmental compensation *after* the event, if at all, rather than upon prior governmental assurance.

Secondly, the U.K. bill seems to cover liability problems of maritime reactors as well as land based power reactors. Maritime reactor licensees will be required to obtain the five-million-pound liability insurance, after which they will be able to substitute liability (and insurance) under this bill for any other liability that might arise. Moreover, maritime limitation of liability statutes are made non-applicable to nuclear liabilities by the U.K. bill, while in the U.S. only the SAVANNAH has been considered, and no general approach to nuclear maritime problems has been attempted.

OEEC AND EURATOM

ON THE CONTINENT, the nuclear liability problem has been studied by the 13-nation Organization for European Economic Cooperation (OEEC), which is composed of all European countries outside the Soviet orbit except Spain. A steering committee for this group has succeeded in drafting a convention which would establish liability, in the event of an accident, on the reactor operator. This is highly desirable from the point of view of the American

manufacturer who might have supplied reactor parts; but the convention provides exceptions for any contrary contract provision, or any law of the member State. Moreover, the liability is limited at about $5,000,000, which seems ridiculously low from the public's point of view, and might invite a suit in the United States on the theory that the convention was "contrary to public policy."

Most importantly for our purposes, however, the OEEC countries expressly have decided at least for the moment not to tackle the nuclear maritime problem, but to postpone it for consideration in a subsequent convention.

The OEEC draft convention, which has been submitted to the member states for consideration, represents a good start on European nuclear indemnity problems.

EURATOM, consisting of six West European countries (West Germany, France, Italy, Belgium, Netherlands, and Luxembourg) has embarked on an ambitious program to construct 1,009,000 KW of atomic power by 1965, using United States type reactors, with United States assistance, pursuant to the Euratom Cooperation Act of 1958. That Act, in a section 8 added by the Joint Committee, expressly provides that the U.S. Government shall assume no liability in connection with operation of the reactors, and thus places the responsibility upon the EURATOM Governments for action.

Here again, the EURATOM countries, so far as I know, have postponed any consideration of the maritime nuclear indemnity questions.

THE INTERNATIONAL AGENCY

THE INTERNATIONAL ATOMIC Energy Agency, consisting of some 80 countries in an organization roughly parallel to the UN, has recently convened an international panel of experts headed by Ambassador Paul Ruegger of Switzerland to consider international indemnity problems. Mr. Edward Diamond, Associate General Counsel of the AEC, has been named the United States member of this panel, and Mr. Peider Konz (who worked on the Atomic Industrial Forum-Harvard Law School Report on "Financial Protection Against Atomic Hazards: The International Aspects") has been named Secretary of the panel. Also, Mr. Sterling Cole, a former Congressman and colleague on the Joint Committee, is the Director General, or Chief Executive Officer of the Agency staff. He is an excellent lawyer and well familiarized with nuclear indemnity problems.

It seems entirely necessary and logical that this expert panel should study international nuclear indemnity problems associated with maritime ships, as well as with land based reactors.

SPECIAL MARITIME LIABILITY PROBLEMS

ARE THERE ANY special liability provisions in our existing maritime law which should be considered in approachng liability questions of nuclear ships?

A cursory examination shows at least two such provisions.

First, there is 46 U.S.C. § 781, which waives the normal governmental immunity, and permits actions against the United States "for damages caused by a public vessel of the United States. . . ." Moreover, 46 U.S.C. § 785 permits suit by a foreign national in a United States District Court if the foreign government "allows nationals of the United States to sue in its courts."

Thus, in the case of the NS SAVANNAH (a United States owned and operated nuclear maritime ship), our existing maritime statutes would seem to permit suit against the United States in the event of a nuclear catastrophe causing damage to the public. Moreover, if the accident should occur in a foreign port, the statute would permit suit against the U.S. Government in our federal courts, provided the plaintiff is a national of a country providing corresponding rights to US nationals.

Secondly, 46 U.S.C. 183 (our existing maritime statutes) provides the following limitation of liability feature:

> "(a) The liability of the owner of any vessel, whether American or foreign, for any embezzlement, loss, or destruction by any person of any property in or for any loss, damage, or injury by collision, or for any act, matter, or things, loss, damage, or forfeiture, done, occasionally, or incurred, *without the privity or knowledge of such owner or owners*, shall not, except in the cases provided for in subsection (b) of this section, exceed the amount or value of the interest of such owner in such vessel, and her freight then pending.
>
> "(b) In the case of any seagoing vessel, if the amount of the owner's liability as limited under subsection (a) of this section is insufficient to pay all losses in full, and the portion of such amount applicable to the payment of losses in respect of loss of life or bodily injury be increased to an amount equal to $60 per ton, to be available only for the payment of losses in respect of loss of life or bodily injury. If

such portion so increased is insufficient to pay such losses in full, they shall be paid therefrom in proportion to their respective amounts." (*emphasis added*)

Thus, under the above statute, the liability of the owner ship, in the event of a nuclear accident, would be limited to the interest of the owner in the vessel and her cargo, plus $60 per ton for personal and death injuries. In the case of a 20,000-ton nuclear ship (twice the size of the SAVANNAH), this would be the value of the ship and cargo for property damage, plus $60×20,000 tons, or $1,200,000 for personal and death injuries. This is, of course, far below the governmental indemnity of $500,000,000 provided by the Price-Anderson Act to satisfy claims arising out of operation of land based power reactors.

The statute provides an exception, as indicated in the quote above, in the case of "privity or knowledge" of the owner. In the case of an accident involving a nuclear-powered ship, it might be argued, I should think, that the owner must have had advance knowledge of the possibility of extensive damages that might be incurred in the event of a collision or accident of a nuclear-powered ship. Thus the limitation of the statute might be avoided.

INTERNATIONAL CONVENTIONS AND AGENCIES

MARITIME PROBLEMS AND the laws of the sea are "a natural" for international conventions. Nuclear hazards and liability problems have not yet been thoroughly explored, but safety regulations and shipowner's liability problems have been the subjects of many conventions, including the following:

1910 Brussels Convention on Collisions;
1926 Convention on Immunity of State Vessels (46 USC 751–53; 781–90);
1926 and 1944 International Sanitary Conventions;
1948 Convention for the Safety of Life at Sea;
1948 International Rules of Navigation (1951); 65 Stat. 406;
1957 Brussels Convention on Shipowner's Liability (Note also 1924 Brussels Convention);
1958 Geneva International Convention on the Law of the Sea.

At this last conference, it was finally resolved that all states should take measures to prevent pollution of the seas from the dumping of radioactive waste, taking into account any standards and regulations which may be formulated by the competent international organizations. The International Atomic Energy Agency subsequently convened an international panel of waste disposal experts.

The 1958 Convention thus touched upon pollution of the seas, but the liability questions arising out of an accident were not resolved. They may be discussed at the Convention on Safety of Life at Sea scheduled to be held in London in the Spring of 1960.

It should be noted that the United States has not joined in nor ratified a number of the International Conventions referred to above, in some instances because the convention has set limits of shipowner's liability too low to satisfy the policy of our government. Perhaps it will not be possible to reach agreement during the 1960 Convention, particularly in view of the other nations' lack of experience in operating nuclear ships by most or all other governments.

As I mentioned earlier, I have considerable hope that the International Atomic Energy Agency will be able to formulate rules and standards of liability for operation of nuclear ships on the high seas and in foreign ports.

MORE EFFORT IN NUCLEAR SHIP PROPULSION NEEDED

I CANNOT CLOSE this article without digressing briefly from legal problems into the realms of policy in order to state my conviction that the United States can afford more effort in the field of nuclear propulsion than is being made at the present time. Last year I proposed construction of 100 nuclear-powered submarines. I believe our nuclear submarine program should be expedited and accelerated, particularly those equipped to carry Polaris missiles. In addition, members of the Joint Committee have long been interested in using nuclear propulsion in the field of maritime ships. Senator Anderson, the Chairman of the Committee, has advocated for three years the construction of a nuclear-propelled oil tanker, which is perhaps the most promising type of ship because of its short loading and unloading time, and its ability to remain underway and at sea approximately 90 percent of the time. Also special ports and unloading facilities for nuclear tankers could easily be constructed in less populated areas, with minimum risk to the public.

The possibility of accelerated construction of more nuclear-powered ships emphasizes the

(*Continued on page 24*)

THE ATOM AT SEA

International Law and Nuclear Shipping

By CAPT LEONARD R. HARDY, USN*

THE DEVELOPMENT OF the first atomic battery was announced by the White House on 16 January 1959. Pictures of the President standing beside this five pound unit (equivalent to 1,450 pounds of conventional batteries) appeared in most of the nation's newspapers and accompanied the heralding of this spectacular accomplishment. The following day there appeared in many of the same newspapers skillfully written editorials suggesting that the President had been in mortal danger from this thermo electric converter. To many, the suggestion seemed valid. To others it did not. To all it should have indicated that nuclear power developments are continuing to be greeted with suspicion and distrust.

From the beginning of time man has been suspicious—indeed often critical—of marked changes in his environment. It should come with no surprise then, if modern man shows an innate caution of "newness" even when this characteristic impedes progress. This unfortunate attribute has evidenced itself in such fields as medicine, science, sociology, economics, and transportation. Most school children know of the painful growing stages of public acceptance experienced by the railroad, the automobile, the aircraft, and the steam-powered ship. Stories of those by-gone days are frequently greeted with much amusement in the classroom of today even though they were of grave import to the scholar of yesterday.

In many ways it is unfortunate that nuclear fuel, unlike the other fuels of today, had its genesis in the most deadly weapon the world has even known. It was the tremendously destructive power of the atom that first occupied the spot light. Peaceful uses of atomic energy followed as if by afterthought. As a consequence many people still think of horrible insidious death when they think of nuclear energy, to them the atom cannot but have an almost immoral connotation. Nuclear power is virtually certain to suffer from its past history unless man strives to consider its development in a rational manner, free from uninhibited emotionalism.

IT HAS BEEN the task of the scientist, the designer, the engineer, and the operator to make nuclear power safe. This they have done. The records of the Nautilus, the Skate, the Sea Wolf, and of many shore based power reactors are convincing proof that the American developers of nuclear power have accomplished the task. Yet, in the international community of nations this scientific accomplishment and demonstration is not enough. The task now confronting the United States is to convince others that our power reactors are safe. The very future of nuclear power may depend upon our ability to do so. Unless the United States can demonstrate and obtain a world-wide "social acceptability" of the nuclear powered ship, this power plant may find itself forever relegated to the confines of the laboratory and to weapons of war. "Social acceptability" can be expected to develop within a frame of acceptable international rules—rules which define the standards of safety that the nations of the world will demand for the welfare of mankind.

Today the nuclear powered ship is, in the eyes of international law, no different from any other power propelled ship. American nuclear submarines have been enthusiastically accepted in the United States and in other nations. There is every indication that other nuclear type ships will be received with equal enthusiasm. There are many, however, who caution that "freedom" should not be the rule in the case of the ship powered by the atom; that some affirmative restrictions should be applied to this new device by appropriate and recognized process of international law. Indeed, there has been one instance of a nation not wanting to have a power reactor operating in its waters. Other nations might undoubtedly have a similar view if con-

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fronted with the likelihood of a visit by a nuclear powered ship.

Clearly then, a heavy responsibility for the future of nuclear power at sea rests in the hands of the international rule maker—the scientific problem becomes a politico-legal problem. Should nuclear powered ships have all the freedom of conventional ships or should they be restricted in their operations? This is the question which must be decided in the development of international rules and in this decision-making process man cannot afford to let judgment be swayed by emotions or prejudices either for or against nuclear power.

THE INFLUENCE OF the legal profession in this development must not be underestimated. While domestic law is created by legislatures which are not necessarily composed primarily of lawyers, international law is based on either international practices, most of which came into existence on the advice of lawyers, or international agreements, in the formation of which lawyers usually play the major role. It is well, therefore, for the professional naval officer and others charged with a responsibility in planning for and operating naval nuclear powered ships to consider the questions which may be raised by the international lawyer in his attempt to establish a rule of law acceptable to the International Community of Nations. To the United States the rule of law is of particular significance for, notwithstanding arguments concerning the efficacy of the international norm, should a rule of international law be developed it would be self-enforcing for this country.

A basic concept which must be accepted in any study of the law of nuclear powered ships is that such ships can be designed, built and operated in such a manner that they pose no significant hazard to man and his resources. There is certainly ample evidence to support the validity of that hypothesis. Another necessary hypothesis is that the general use of nuclear power is desirable for man's overall welfare. In this connection, it is generally conceded that there will ultimately be a crucial shortage of fossil fuels therefore it is reasonable to assume the desirability of nuclear fuels.

Based upon the two hypotheses stated above, it is clearly apparent that nuclear powered ships should enjoy the freedom of operation afforded their conventional sisters. There can be no doubt, however, that nuclear fuels may be potentially more dangerous than any other power source which has been used on the seas. The law should, therefore, strike a happy medium. It must provide for virtually complete freedom of action for *safe* nuclear powered ships, but almost complete prohibition against ships which are *not safe*. For a body of law with as little enforcement machinery as international law, this poses quite a formidable task.

THE FIRST REQUIREMENT stated above, namely, to provide for freedom of operation for safe nuclear powered ships, requires no action at all. As stated previously, unless some affirmative regulatory action be instituted, such ships will enjoy all of the freedom enjoyed by conventional ships. The lawyer must devise, and urge heads of states to adopt procedures which will be selective and effective enough to weed out only the unsafe ship and not hamper the safe one.

It is unrealistic to believe that adequate and effective steps can be taken to deny the use of the high seas to a nuclear powered ship which is not safe. As a matter of fact, it is extremely doubtful, from the standpoint of international law, if it would be unlawful for a nation to operate an unsafe nuclear reactor so long as it restricted the locus of its operations to the high seas and the nation's own territorial and internal waters. The generally accepted rule is that any nation has a right to use the high seas so long as its use does not unreasonably interfere with the rights of other users. An unsafe nuclear powered ship would not, except possibly in the event of a collision, unreasonably interfere with the lawful use of the high seas by another ship. The nature of the fuel element in a power reactor is such that, even under the most serious accident conditions, it cannot become an atomic bomb. Except in a collision, the effect of any nuclear accident would usually be localized in the ship itself and not on its environment or adjacent ships.

Ships do not, however, go to sea for the purpose of staying on the high seas. Merchant ships are useful only because they can transport materials and persons to the ports of the world. Naval ships must come into port periodically. It is in the ports, therefore, that the opportunity to control nuclear powered ships is presented. It is also only in the ports and coastal waters that such ships present any significant danger to anyone other than themselves and their complement.

FORTUNATELY, THERE ALREADY exists the machinery with which to control conventional powered ships which attempt to use the ports of the world in international commerce.

The majority of the maritime nations have agreed, in the International Convention on Safety of Life at Sea, 1948, on the principles, standards and guide lines necessary to insure the safety of ships in international voyages. Each signatory power certifies its own ships as being in compliance with the Convention. Chapter I, Regulation 18 of the Convention authorizes all signatory powers to inspect any ship of another signatory power to insure that the ship is properly certificated and that the conditions of the ship's seaworthiness correspond substantially with the particulars of its certificate. Ships of non-signatory powers are inspected for safety and seaworthiness in American ports by the U.S. Coast Guard under the provisions of applicable regulations in 46 CFR, Chapter 1. Other maritime powers undoubtedly have similar regulations regarding inspections. All maritime powers can have them if they so desire.

It is apparent, therefore, that unsafe ships can be excluded from the ports of any nation if that nation cares to exert the effort necessary to do so. In this connection, it must be remembered that, while ships have the *right* of innocent passage through territorial waters, they have only a *privilege*, exercised at the will of the coastal state, to enter internal waters.

There is certainly nothing like the degree of technical knowledge and experience among the maritime nations today to make it possible to attempt to obtain an international convention on the detailed safety requirements for nuclear powered ships. Neither is there any present need for such a convention because no nuclear powered merchant ship is yet afloat. It is, however, appropriate at this time to establish procedures, either by bilateral or multilateral agreement, or by practice of maritime nations, whereby a safe nuclear powered ship can be assured entry into the commercial ports of the world while, at the same time, unsafe ships will be denied entry.

THE REQUIREMENTS OF the United States Atomic Energy Commission for the licensing of other than military power reactors suggests a procedure which would be eminently suited for international use in connection with nuclear powered ships. Under a similar procedure, a shipping line of Country A, which wished to build a nuclear powered ship to trade between its home ports and ports of Country B, would submit to the authorities of Country B a report containing the essential details of the design, construction, installation and operating procedures of the ship and its power plant. If, upon review of the report, Country B determines the ship to be safe, it would then authorize the ship to enter its ports. Upon arrival of the ship at Country B's port for the first time, it could be ordered to a quarantine, explosive or other suitable anchorage for inspection to determine if it actually meets the standards which were stated in the report furnished previously by the owner. If so, the ship would then be free to trade in B's ports in the same manner as a conventional ship. If not, it would be required to leave B's waters immediately.

One argument which can be presented in opposition to the plan outlined above is that, at the present time, few states have the technical knowledge necessary to determine whether or not a particular ship is safe. That may well be true at the moment, but it is a condition which need not necessarily exist for much longer. There are now available technical publications which provide sufficient information to enable the trained physicist, engineer and ship designer to approach the review of the plans of a nuclear powered ship with considerable confidence. An example of a helpful publication is the *Safety Considerations Affecting the Design and Installation of Water-Cooled and Water-Moderated Reactors on Merchant Ships* which, it is anticipated, will soon be published by the Society of Naval Architects and Marine Engineers. In addition, there are several international or intergovernmental bodies, such as the International Atomic Energy Agency and the ship classification societies such as American Bureau of Shipping, which have, or will have, a considerable degree of technical competence in the field of peaceful uses of nuclear energy. Such agencies would probably be willing to provide technical advice and guidance to any nation on the design of a nuclear powered ship.

It is of particular importance that such a procedure be instituted and have a general international acceptance at this time while nuclear powered shipping is in its infancy. This is the point which makes the international lawyer so important because he can, by his wise counsel and practical guidance, particularly in the politico-legal field, insure the early creation of a favorable climate of international opinion and state of international and domestic law which is essential to the development of nuclear powered shipping. Now is the time when such steps must be taken. Merchant ships are built to make a profit for their owners. They represent a tremendous investment long before they commence to earn profits. No owner will risk his

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RADIOACTIVE WASTE DISPOSAL

Mobility and Freedom for Nuclear Seapower

By LCDR JAMES H. DOYLE JR., USN *

THE FREE WORLD thrilled at the word of the epic-making voyages of NAUTILUS and SKATE. The SEAWOLF's endurance record forecast what Rear Admiral Galantin described as the capability for "exploiting the oceans of the world not just as a fluid plain for movement, but as a vast zone of three-dimensional operations".[1] The launching of the TRITON and the construction of the LONG BEACH and ENTERPRISE are unmistakable signs of the transition from steam to nuclear power. As this transition progresses, the unique capabilities of our naval forces, particularly in the field of sustained global mobility, will be greatly enhanced.[2] The delivery of the SAVANNAH expected in 1960, will pioneer efforts toward increasing our merchant ship capability—a capability vital to the oceanic confederation of the free world.[3] The development and operation of the atomic power station at Shippingport, Pa. will usher in the age of electric energy produced by nuclear power. Continued investigations into the possible use of nuclear explosions for such purposes as mining and earth moving (Project Plowshare), and research in the physical and life sciences indicate the range and scope of atomic research and development in the peaceful applications of this new energy source. On the international scene, the nations of the world are fast exploiting the tremendous potential in atomic energy. These and other developments highlight the emergence of this new industry in a period of less than 15 years.

One of the problems inherent in the evolution of every industry is the disposal of its wastes. The fact that the wastes we are concerned with in atomic energy consist of materials producing radioactivity presents additional considerations in the politico-legal field. Disposal of these radioactive wastes at sea further brings into focus some basic principles of international law and policy.

SOURCES AND NATURE OF RADIOACTIVE WASTE

BEFORE EXPLORING THESE "uncharted legal seas", and at the risk of greatly oversimplifying the problem, let us identify briefly the general nature and sources of radioactive wastes.

Atomic energy and its by-products influence us by virtue of the ionizing radiation they produce. This radiation is not detectable by the human senses, but its nature and character can be determined by appropriate instrumentation and analysis. It is composed of particulate matter, of electromagnetic waves, or both. It is similar to the natural radioactivity to which all of us are exposed. Natural sources of radiation include cosmic rays, traces of uranium and radium in rocks, of radium in drinking water, and of radioactive carbon and potassium in food. Artificial sources include hundreds of radioactive isotopes of widely varying intensity and durability.[4] The common types of ionizing radiation are gamma rays, x-rays, alpha particles, beta particles, and neutrons. Radioactive materials are measured in grams for weight and curies for amount of activity, or fractions of a gram or a curie.[5]

The utilization of fissionable material in the

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1. "Though it is, indeed, a direct result of endurance, the essential significance of nuclear propulsion is that now the submarine can operate for virtually unlimited periods *below the zone of most probable detection.*" Galantin, The Future of Nuclear-Powered Submarines, Nav. Inst. Proc., June 1958, p. 23, 25.
2. "This is sea-power—mobile power—in a new and awesome form. It poses a challenge to the fixed-base systems of such land-locked powers as Russia and China to which no ready answers are available." Eliot, If You Can't Move It, You Can't Use It, Navy, Oct. 1958, p. 41, 42.
3. "When we speak of seapower, however, we should not confine our vision to naval forces. Seapower does not mean a Navy alone. It includes freighters, tramp steamers, passenger liners, tankers and the many other ships which make up the Merchant Marine . . . Maritime shipping is our principal link with our overseas allies. The freedom of the seas in peace, and the ability to control the seas in war, is a basic source of the strength of the Free World." Address by Admiral Arleigh Burke, USN, Chief of Naval Operations, before the Newcomen Society, U.S. Coast Guard Academy, New London, Conn., 14 Oct. 1958.
4. E.G., radioactive iodine^{134} has a half-life of only 8 days, while radioactive iodine^{139} has a half-life of only 25 minutes; cesium^{137} and radium^{226} have half-lives of 30 and 1,590 years, respectively. (Half-life is time required for half of its radioactive nuclei to disintegrate).
5. For detailed analysis, see Garland, Medical Aspects of Hazards from Atomic Energy and its By-Products, 25 Ins. Couns. J. 513 (1958).

controlled production of thermal energy or in sudden explosions results in highly radioactive products. Thus, at the various steps from the mining of the ore to the development of power, radioactive wastes are produced which vary greatly in quantity, level of activity, toxicity, and chemical and physical form.[6] The levels of activity range from hundreds of curies per liter in high level wastes to fractions of microcuries per liter in low level wastes.

LET US EXAMINE specifically the sources of radioactive waste from nuclear powered naval ships.[7] From studies and analysis of operating naval nuclear reactors and prototypes, conducted under the auspices of the Nuclear Propulsion Division of the Navy's Bureau of Ships, it has been determined that the principal source of waste is the reactor coolant water which contains small quantities of activated impurities. The largest amounts of reactor coolant water are discharged when this water expands as a result of bringing the reactor plant up to operating temperature.[8] The radioactive nuclides of most concern result from activation of the small amounts of corrosion and wear products of plant surfaces and from activation of small amounts of impurities in the coolant water.

In addition to activated impurities, the reactor cooling water may contain trace amounts of fission products. These come from minute quantities of uranium impurity in the reactor structural materials. The large quantities of fission products that are produced by the fission process of the reactor are retained where they are born: metallurgically bound within the fuel alloy.[9] The other sources of radioactive waste derived from the operation of naval nuclear power plants include (a) the ion exchange resin that is used to purify the coolant water of the reactor plant, (b) reactor shield water, (c) solid wastes from maintenance operations (metal scrap, pieces of insulation, rags, sheet plastic, and paper), and (d) special wastes from laundry or decontamination operations (decontamination of radioactive tools and equipment and laundering of radioactive anti-contamination clothing). At this point it should be noted that the direct radiation emanating from the hull of any nuclear powered naval ship is designed to be insufficient to cause any detectable activation of the sea water.

From a cursory look into the various sources of radioactive waste, it is apparent that one cannot generalize on the effects of disposal, particularly disposal at sea. However, this is exactly what a large number of nations did at the recent Geneva Conference on the Law of the Sea and, as in the case of a nuclear explosion, the result was more thermal than luminous.

GENEVA LAW OF SEA CONFERENCE

EIGHTY-SIX NATIONS met in Geneva last February to codify the law of the sea.[10] After slightly over two months of discussion, debate, and toil, in which strictly legal arguments were submerged not only by economic and security considerations but also by those of bloc solidarity and good old-fashioned horse trading, four conventions were hammered out and are now subject to ratification.[11] In addition, nine

6. Liquid, gaseous and solid states, or in intermediate form, and either combustible or non-combustible. "When the fuel is irradiated by neutrons in the reactors, tremendous amounts of heat are produced. Since such reactors are cooled by air, water, liquid chemicals or other media and since these are in turn exposed to neutrons in the reactors, they become irradiated . . . . When reactors are disassembled their irradiated parts are removed . . . Since the burn-up in most reactors represents a very small percentage of the fuel installed, it is economically essential in present practice to recover unburned portions. Associated with these irradiated fuels which are to be recaptured for further use are the fission products which have resulted from the processes. These have radioactive half-lives varying from seconds to millions of years. . . . (and) . . . contain almost the entire spectrum of fission products when the uranium atoms are split". Wolman, The Nature and Extent of Radioactive Waste Disposal Problems, Hearings before Joint Congressional Committee on Atomic Energy on Industrial Radioactive Waste Disposal, Jan.–Feb. 1959, p. 4, 5. (hereinafter referred to as HEARINGS).
7. All nuclear propelled U.S. naval ships now planned, in construction, or in operation are powered by pressurized water reactors. Generally, the nuclear propulsion plant consists of a nuclear reactor case contained in a pressure vessel; a primary coolant system utilizing fast-flowing pressurized water to remove the heat generated by nuclear fission in the case and transfer it via a steam generator to the secondary, or steam system; a steam machinery plant for propulsion and auxiliary electric power generation; and radiation shielding. See Hosmer, Nuclear Power for the Navy, Nav. Inst. Proc., May 1958, p. 57.
8. Normally, this happens a few times per month on each ship and the quantity of coolant water discharged on each heat-up averages about 500 gallons.
9. "They cannot get out of the fuel elements unless by a very remote possibility the reactor itself were to melt down. The plant is protected against this possibility by its inherent safety characteristics and by a 'fail-safe' protection system, although the possibility of such an accident cannot be completely eliminated. If the ship were sunk, it is expected that the reactor case could remain submerged in sea water for decades without release of fission products, since the zirconium protective ladding on the fuel elements corrodes only a few millionths of an inch per year. The steam system is entirely separate from the reactor system, and a failure in the steam system would not endanger the reactor nor release fission products or activated impurities". Nuclear Prop. Div. BuShips, Radioactive Waste Disposal from U.S. Naval Nuclear Powered Ships, HEARINGS, p. 5.
10. The General Assembly of the United Nations, by its Resolution 1105 (X1) adopted on February 21, 1957, called for a conference of its members to "examine the law of the sea, taking account not only of the legal but also the technical, biological, economic and political aspects of the program, and to embody the results of its work in one or more international conventions or such other instruments as it may deem appropriate." U.N. General Assembly, 11th Sess., Official Records, Supp. No. 17 (A/3572).
11. Convention on the Territorial Sea and the Contiguous Zone (U.N. Doc. A/Conf. 13/L.52); Convention on the High Seas

resolutions and an optional protocol of signature concerning the compulsory settlement of disputes emerged from the Conference.[12]

The Conference had the benefit of six sessions of prior work by the International Law Commission of the United Nations (ILC). The final report of that Commission, produced in its eighth session in 1956, set forth draft articles, with commentary.[13] These articles, 73 in all, served as the working papers of the conference. Although only two of the articles—article 27 on freedom of the high seas and article 48 on pollution of the high seas—dealt with atomic energy and the disposal of radioactive waste, the debate which followed was as prolonged and heated as it was on any of the other controversial issues.

Before taking up the individual articles, it might be well to consider briefly the atmosphere in the Conference arena. Of course, the major problem facing the Conference, was the determination of the breadth of the territorial sea. The United States advocated retention of a narrow breadth of territorial sea as vital to the interests of the free world.[14] The Soviet bloc was insisting on a 12 mile or greater territorial sea, but was also bound and determined to put the stamp of "illegality" on nuclear testing on the high seas.[15]

The attitude of some of the Arab League countries toward the problems of the law of the sea was colored by the issue of Israel's right of passage through the Straits of Tiran into the Gulf of Aqaba. Several newly created states brought to the Conference a body of resentment toward those to whom they formerly were in a colonial position. Nationalism was on the rise.

The fishing interests of the various nations were numerous and divisive. Difficult economic situations existing in many areas of the world, particularly in Latin America, imposed a variety of needs on many countries. In short, the delegates at Geneva reflected the significant changes which have developed in the political philosophy, economic status, ambitions, and affiliations of both the older and newer nations.[16] Against this background of a variety of conflicting claims and purposes, advances in technology and new political alignments, the issue of "pollution of the seas by radioactive materials and wastes" was considered.

IN COMMITTEE II, which considered all articles concerning the regime of the high seas, the opening gun was fired by the delegate from Poland. He expressed doubts as to the legality of conducting nuclear tests on the high seas and as to whether the ILC had gone far enough in laying down prescriptions against pollution of the sea by radioactive wastes.[17] The Soviets followed by launching a vigorous propaganda campaign against nuclear testing on the high seas. They capitalized on the ignorance and emotionalism which characterize much of the discussion of the effects of large amounts of radioactivity on the oceans and fisheries. They blandly ignored the fact that radioactive fallout on the high seas was the result of nuclear testing on land as well as on the seas. Most significantly, the Soviets added to the confusion that carried through all discussions of Articles 27 and 48—that is, that the radioactive fallout from nuclear testing was identical to all other forms of radioactive waste which might normally be released on the high seas; and that both would have the same environmental effects.

Faced with a growing campaign to ban nuclear testing on the high seas, the U.S. delegation, among others, worked to set the record straight. Admiral Colclough, senior U.S. representative on Committee II, pointed out that since the United States conducted nuclear tests under rigid control to ensure a minimum degree of interference with the use of the high seas by other states, it was convinced that such use was *reasonable*, and consequently legal. He observed that the whole question was closely interlinked with the problem of disarmament. If the conference were to concern itself with a relatively narrow aspect, there would be a danger of upsetting delicate negotiations on a vital subject.

In the ensuing debate on Article 27, a number of states went on record as opposing nuclear tests on the high seas.[18] The Soviet bloc proposed an amendment to the article which would

(U.N. Doc. A/Conf. 13/L.53); Convention on Fishing and Conservation of the Living Resources of the High Seas (U.N. Doc. A/Conf. 13/L.54) and Convention on the Continental Shelf (U.N. Doc. A/Conf. 13/L.55). At present, each of these conventions has been signed by at least 35 nations including the United States. They will go into effect after 22 ratifications.

12. U.N. Doc. A/Conf. 13/L.56; U.N. Doc. A/Conf. 13/L.57.
13. International Law Commission Report, U.N. General Assembly, 11th Sess., Official Records, Supp. No. 9 (A/3159).
14. For an excellent report on the Conference see Dean, The Geneva Conference on the Law of the Sea: What Was Accomplished, 52 Am. J. Int. L. 607 (1958); see also Dean, Freedom of the Seas, 37 Foreign Affairs 83 (1958).
15. Or for that matter, the use of the high seas for naval exercises and maneuvers. See statement of Soviet delegate in Committee II on 10 Mar. 1958, U.N. Conf. on Law of Sea, official records, Vol. IV, A/Conf. 13/40, p. 9 (hereinafter referred to as SECOND COMMITTEE).
16. See Gorman, The 1958 International Conference on the Law of the Sea, HEARINGS.
17. SECOND COMMITTEE, p. 6.
18. Albania, Bulgaria, Burma, Ceylon, Czechoslovakia, India, Japan, Nepal, Rumania, Ukrainian S.S.R., USSR, UAR; and Yugoslavia.

have banned such nuclear testing,[19] but it was defeated. Article 27 was finally adopted by the Conference as follows:

Article 2 (Old Article 27)

The high seas being open to all nations, no state may validly purport to subject any part of them to its sovereignty. Freedom of the high seas is exercised under the conditions laid down by these articles and by the other rules of international law. It comprises, *inter alia*, both for coastal and non-coastal States.

1. Freedom of navigation;

2. Freedom of fishing;

3. Freedom to lay submarine cables and pipe lines;

4. Freedom to fly over the high seas.

These freedoms, and others which are recognized by the general principles of international law, shall be exercised by all States with reasonable regard to the interests of other States in their exercise of the freedom of the high seas.[20]

However, it was clear from the debate that a substantial number of delegates wished to formally express themselves on the subject of nuclear testing. India offered a resolution which referred the matter of nuclear testing as an infringement of the freedom of the seas to the UN General Assembly for appropriate action. This resolution was adopted by the Conference by a vote of 58 to none with 13 abstentions.

With regard to Article 48, paragraph 2, the United States voiced concern that the draft article as written would lead to varying unilateral regulations on the subject of radioactive waste disposal. (This matter was under study at the time of the Conference by the UN Scientific Committee on the Effects of Atomic Radiation). The draft article was also defective in that it did not deal with the basic problem of international agreement on what constitutes pollution.[21] Here, as in debate on Article 27, it was soon apparent that many nations were adamant in their insistence on the adoption of regulations forbidding "pollution" of the high seas by radioactive materials of any kind. In an effort to head off adoption of the ILC draft article, the US and UK sponsored a resolution which referred the problems of pollution of the seas by discharge or release of radioactive materials to the International Atomic Energy Agency (IAEA) and other competent bodies. This resolution, intended as a substitute for Article 48, pars. 2 and 3, was ultimately adopted by the Conference. However, its passage in Committee II (30 to 29 with 6 abstentions) was resented by a number of nations on the grounds that the resolution was an effort to remove the issue of radioactive pollution of the seas from the jurisdiction of the Law of the Sea.[22] A substitute Article 48, pars. 2 and 3, was sponsored by Argentina, Ceylon, India and Mexico, making it plain that the US and UK resolution would not carry in plenary session unless Article 48 contained something on the subject of radioactive waste disposal.[23] Subject to some changes, the US supported this 4-power proposal, which was ultimately adopted by the Conference in the following form:

Article 25 (Old 48, pars. 2 and 3)

1. Every State shall take measures to prevent pollution of the seas from the dumping of radioactive wastes, taking into account any standards and regulations which may be formulated by the competent international organizations.

2. All States shall cooperate with the competent international organizations in taking measures for the preventon of pollution of the seas or air space above, resulting from any activities with radioactive materials or other harmful agents.

FROM THE DEBATE at the Conference, it is obvious that disposal or release of radioactive wastes to the oceans, as well as the fallout effects of nuclear testing on the high seas, is a matter of great concern to all nations. It is equally clear that the members of the world community wished to retain these subjects within the jurisdiction of the law of the sea. Although they were willing to leave strictly technical matters to an international body such as the IAEA, they insisted on the right to make decisions involving the effects of these atomic energy activities on the seas. The subject of radioactive waste disposal is not merely a technical problem. It has international as well as national aspects, and can be expected to be considered at high levels in the various governments.

Specifically, the following conclusions on the legal aspects of Article 27 and 48 emerge:

1. As to nuclear testing on the high seas, while the question was referred to the General Assembly, such nuclear testing *per se* was not considered contrary to international law. Attempts to place the stamp of illegality on these activities were specifically rejected. In fact, the new article on freedom of the seas sanctions such testing so long as it meets the criterion of *reasonableness*. That U.S. nuclear test-

19. SECOND COMMITTEE, p. 124.

20. U.N. Conf. On Law of Sea, official records, Vol. II: Plenary Meetings, A/Conf. 13/38, p. 20 (hereinafter referred to as PLENARY). Underscoring indicates additions made to ILC draft.

21. SECOND COMMITTEE, p. 15, 16.

22. After the resolution passed in Committee II, the delegate from India stated:

"He had voted against the resolution because it embodied a clear attempt to shirk the responsibility which the International Law Commission—an impartial body—had specifically included in their draft. The pollution of the high seas by dumping of radio-active waste was in any case contrary to international law." SECOND COMMITTEE, p. 93.

23. While a bare majority was sufficient to carry in Committee, two-thirds was required in Plenary for Conference adoption of an article.

ing on the high seas meets this test of reasonableness can no longer be disputed.[24]

2. As to the disposal or release of radioactive wastes to the oceans, such activities *per se* were not considered contrary to international law. Attempts to brand such disposal as illegal were also specifically rejected. The objectionable features of the ILC draft article 48 on this subject, which might have encouraged varying unilateral regulations, have been eliminated. With the adoption of the resolution, it is clear that the Conference intended that action under the new article 25 await the development and formulation of international standards, and that nations in fact cooperate with competent international organizations. In addition, reading the resolution along with the article gives a substance to the word "pollution". In fact, it can be argued that the test of reasonableness is also to be applied in the case of waste disposal when considering the "amounts which would adverely affect man and his marine resources". The resolution specifically takes into account action proposed and studies made by various national and international bodies, and notes certain recommendations already made by the International Commission for Radiological Protection (ICRP).

There is no question that the IAEA faces a complex technical task. But it also faces the job of educating the world community on the subject in order to overcome some existing deep-seated prejudices and widespread misunderstandings. However, it can proceed free of premature and inflexible legal prescriptions.

INTERNATIONAL ATOMIC ENERGY AGENCY

FOLLOWING ADOPTION OF the resolution on waste disposal by the Geneva Conference, the IAEA [25] established a panel of experts to study the subject.[26] The objectives of the panel include the preparation of recommendations which might form the basis for an international agreement. Specifically, the panel will study the problem of (1) package waste disposal, (2) the disposal of low activity liquid effluents from shore based reactors and chemical processing plants, and (3) *wastes from nuclear powered ships*. International registry and monitoring of disposal sites are also being discussed. It was recognized at the outset by the panel members that no general statement of safe disposal rates could be made because of the variability in the phenomena controlling the physical dispersion and movement, the geochemical exchange, and biological reconcentration of radioisotopes in the sea.[27] Each proposed disposal site must be evaluated on its own merits.

The panel will meet again this spring. Various working groups will prepare drafts of specific portions of the final report for consideration by the full panel. Included in the considerations of the various working groups is the requirement for additional research work.

The findings and recommendations of the IAEA will have a significant impact on international law, policies and practices in this field of the disposal of radioactive waste to the seas. One has only to look to the record of the Law of the Sea Conference to document the great weight attached by the world community to reports compiled by experts (in that case the ILC draft articles). The respect so accorded sometimes seems to vary in inverse proportion to the familiarity of the subject. This is not to imply in the least that the findings of the scientists will not be objective. But it may well be that at this stage of oceanographic knowledge, the findings will be far from conclusive. And it would certainly be unrealistic to evaluate the judgments of individual delegates to the IAEA based on such findings without taking into consideration the political realities in the world today and the specific factors influencing certain nations' attitudes toward the question of radioactive waste disposal. The free world has too much at stake in nuclear power to risk jeopard-

(*Continued on page 25*)

24. Supporting the legality of nuclear testing under the doctrine of *reasonableness*, see McDougal and Schlei, The Hydrogen Bomb Tests in Perspective: Lawful Measures for Security, 64 Yale L. J. 648 (1955).

25. The IAEA, established as a result of General Assembly action in 1954 on President Eisenhower's recommendation to the UN in 1953, came into being formally in 1957. There are about 59 member nations. Actually, its first report outlined a program for the study of waste disposal, but initial deliberations of the Agency were primarily concerned with problems of internal organization. See Mehren, The International Atomic Energy Agency—Challenge and Opportunity, 13 Record Assoc. Bar of City of N.Y. 56 (1958).

26. The panel which met in December 1958 is composed of scientists from each of the following countries: Canada, Czechoslovakia, France, India, Japan, the Netherlands, Sweden (Chairman), U.K. and U.S. Also represented on the panel are The Food and Agricultural Organization (FAO), World Health Organization (WHO) and United Nations Educational, Scientific and Cultural Organization (UNESCO).

27. Some of the factors which determine the fate of the radioactive material introduced into the sea include:
1. Physical and chemical form in which material occurs when introduced and mixed with sea water (affects dispersion and reconcentration by biota and bottom materials).
2. Initial mechanical dilution of wastes.
3. Advection of wastes away from source region by currents and simultaneous turbulent diffusion.
4. Uptake of activity onto suspended silt and bottom sediments.
5. Concentration of activity by various parts of biota.
See Pritchard, Environmental Factors Affecting the Disposal of Radioactive Waste Materials into Tidal Estuaries and Coastal Bodies of Water, HEARINGS.

ADMIRALTY IN THE NUCLEAR NAVY

Indemnification Under the Present Laws

By CAPT RICHARD J. HOGAN, USN*

TECHNOLOGICAL DEVELOPMENTS in the field of science have had, it seems, a strong tendency to outstrip the lawyer in an era of profound change. Almost overnight, so to speak, the Navy lawyer has found himself, in effect, launched into outer space [1] and into the atomic sea age. Whole new dimensions have been added to the scope of the Navy legal practice.

The legal profession and the Navy lawyer is prepared to meet the challenges presented—to progress into the fields of space law, with all its complexity and international implications, and to meet the profound changes and problems that the introduction of nuclear power propulsion has brought and will continue to bring into the field of maritime law. This symposium focuses attention on maritime law. With the advent of nuclear power propulsion plants and their installation in the combatant ships of the Navy, critical and vastly interesting legal problems of vital concern to the Navy have been generated. It will be the purpose of this article to explore those new problems which will come within the primary jurisdiction of the Admiralty Division, Office of the Judge Advocate General—a jurisdiction involving the settlement of claims.

In order to set the stage for such a discussion it is essential that the function of the Division and the Navy's jurisdiction with respect to Admiralty law matters be deliniated. Such delinination will serve to emphasize the Navy's experience in handling matters within its Admiralty jurisdiction, prior to the legal complexities introduced by the operation of nuclear powered combatant ships.

THE SETTLEMENT OF claims for damage cause by naval vessels and for damage to Navy property caused by privately-owned vessels are matters handled by the Judge Advocate General of the Navy under two settlement authorization acts which are co-extensive. One act concerns claims against the Navy Department for damage *occasioned by* naval vessels.[2] The other act concerns claims on behalf of the Navy Department for damage *caused to* naval vessels.[3] Under these statutes the Secretary of the Navy has authority to effect settlement and make direct payment or collection where the amount *does not exceed one million dollars.* To relieve the Secretary from the necessity of considering minor claims these acts were later amended so that there has been delegated to the Judge Advocate General final settlement authorization where the payment or collection does not exceed $1,000.

Prior to 1944 the Navy Department's ability to dispose of claims for damage caused by naval vessels was restricted to a recommendation to Congress, where the claim involved did not exceed $3,000. Final settlement was made by the General Accounting Office after Congressional appropriation. Litigation was the only method of disposing of claims in excess of $3,000. The increased settlement authorization was obtained to permit disposition of a vastly increased volume of claims and to obtain the benefit of settlement without litigation. The settlement authorization obviated a clumsy and abhorrent claims handling procedure. Action to attain the now existing settlement authorization from Congress was initiated by the Judge Advocate General. At the time it was considered that the obtaining of such authority was a large step forward. And indeed it was, for it enabled the Navy to make direct and immediate payment to claimants without acquiring an appropriation act or the intervention of the General Accounting Office to obtain payment. It has served very effectively to eliminate costly litigation.

Prior to 1948 Admiralty jurisdiction did not extend to claims for damage to shore structures caused by a naval vessel. With the passage of the Federal Tort Claims Act, however, it became possible to sue the United States for

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1. *Symposium on Space Law*, JAG Journal, Feb. 1959.

2. 10 USC 7622.

3. 10 USC 7623.

damage caused by naval vessels to land structures. After that it was only a matter of the forum. Suit could be brought either under the Tort Claims Act or in Admiralty. By statute,[4] Congress passed an amendment which directly took care of the forum situation and extended the "admiralty and maritime jurisdiction of the United States to all cases of damage or injury to person or property, caused by a vessel on navigable waters, notwithstanding that such damage or injury be done or consummated on land". After passage of that Act the United States became suable under the Public Vessels Act,[5] for such damage.

The Public Vessels Act was passed in 1925. Under it the United States waived its sovereign immunity to suit for damage caused by "a public vessel of the United States". This, therefore, is the act which applies to naval vessels. All suits against the United States, with respect thereto are brought under that Act. It provides, by reference to the Suits in Admiralty Act,[6] that suit must be brought within two years from the date of the occurrence of the injury out of which the cause of action arose.

HAVING THUS SET the stage, the many legal questions which will come within the jurisdiction of the Judge Advocate General by reason of the operation of nuclear-powered combatant ships are manifest. They will be, claims arising out of tort. Essentially, basic tort law will still be applicable in a situation where property damage or personal injuries occur as a result of a nuclear reactor casualty; however, it is the scope and potential enormity of the casualty which is of concern and the practical certainty that many novel questions for adjudication will arise. As an offset against this vast potential, the Navy has now, as distinguished from what was only a few years ago an adequate settlement authority, only relatively limited settlement authority, monetary-wise, to cope with a nuclear casualty situation.

With respect to its public vessels, with few minor exceptions, the United States is self-insured. This is an important point and must be borne in mind as we deal with the matter of the acquisition by the Navy of nuclear reactors and subsequent incorporation of them into its vessels as propulsion power units.

An agreement, dated 8 November 1954, was entered into between the Military Departments of the Department of Defense and the Atomic Energy Commission. This agreement sets forth a statement of policy for the operation and acquisition of nuclear power reactors. It provides also for certain other items relating to statements of policy with which this article is not directly concerned. The agreement provides among other things that; (1) "The operation of military reactor power plants will be the responsibility of the military department concerned"; (2) "The AEC will, as requested by the military department concerned, continue to review and evaluate operating procedures, general safety standards, etc." and (3), that upon transfer of the nuclear power reactor the military department concerned will assume full responsibility for "damages to life and property resulting from the use of fissionable material".

A READING OF THE Atomic Energy Act, and the amendments thereto demonstrates the concern with which our Congress has viewed the potentials of an atomic catastrophe or "nuclear incident". The approach of Congress to the problem has been realistic. This is particularly evident when one considers the enactment in 1957 of the Price-Anderson Amendment to the Atomic Energy Act[7] which provides for disposition of third party liability claims and a governmental indemnity up to $500,000,000. It sets forth a method for indemnifying third parties for personal injury, property damage and death claims arising out of an atomic catastrophe in those situations in which the reactor operators are licensees. Subsequently the Price-Anderson Act was amended to bring within its coverage the NS SAVANNAH, a merchant vessel, now under construction under auspices of the United States Maritime Administration. The amendment limited its provisions, however, to only the NS SAVANNAH.

The Navy, as a military department of the Department of Defense, is not a licensee. To the contrary, the operation of military reactor power plants on board its combat vessels appears to be strictly Navy responsibility. The responsibility of the AEC will have ended at the moment of transfer of the nuclear plant to the Navy. Furthermore, under the agreement referred to, the Navy has assumed responsibility for all "damages to life and property resulting from the use of fissionable material".

On 30 January 1959, the Secretary of Defense forwarded a draft of legislation to Congress to

4. 46 USC 740.
5. 46 USC 781 et seq.
6. 46 USC 741 et seq.
7. 72 Stat 525, P.L. 602, 85th Cong.

authorize the Department of Defense to indemnify prime contractors and sub-contractors, engaged in construction of atomic energy systems, against nuclear and other unusually hazardous risks and to permit the Department to settle directly claims of third persons, within specific limits, against such contractors. This proposed legislation is similar to the indemnification provided for under the Price-Anderson amendment.

IT WOULD APPEAR that the time is ripe to submit to Congress proposed legislation which will provide for, and apply specifically to naval vessels powered with nuclear power propulsion plants, the same type of indemnity protection and authority for the Department to settle third party claims that now exists with respect to the NS SAVANNAH, land based reactors in the hands of licensees and contractors and subcontractors engaged in construction of reactors. It is quite apparent that the settlement authority of the Secretary of the Navy, presently limited to one million dollars, and designed to cover claims for damage caused by naval vessels is obviously totally inadequate when one considers the liability potential involved in a nuclear catastrophe.

It is beyond question that every safeguard conceivable has been incorporated into the construction of nuclear powered naval vessels. The probabilities of a nuclear catastrophe are extremely remote. Should such an incident occur, however, the variety and nature of the casualties which could be generated would no doubt be prodigious.

ONE FACET OF maritime law which affords an area within which the Admiralty lawyer can speculate freely and with considerable interest is that which deals with the matter of Limitation of Liability and possible applications of that doctrine in a catastrophe situation. The Limitation of Liability Act[5] provides that ship owners (the Act applies to United States owned vessels) particularly in disaster cases, can limit their liability to third party claimants to the value of the ship immediately after the event. In other words, if the ship is lost the ship owner can limit his liability, except as to any pending freight, provided the ship owner has the ability to establish that the casualty occurred without his privity or knowledge. If not lost the limit of liability is the value of the vessel in its damaged condition. An affidavit of value is filed with the court and a limitation fund established under custody of the court out of which all claims will be paid.

This is not entirely the situation, however, when death and personal injury claims are involved. The Limitation of Liability Act provides that if the ship owner's liability, as limited, is insufficient to pay all losses in full then he must increase the limitation fund by adding $60.00 per ton, calculated on a basis of gross tonnage, this sum to be available for payment of the death and personal injury claims.

Generally, knowledge on the part of the master or crew cannot be imputed to the owner. In cases where vessels are in collision and one ship owner or both, seek to limit liability he can be prevented from doing so if it is established that his vessel was unseaworthy and such unseaworthiness either contributed to the collision or was in fact the proximate cause. As an example, if a vessel is improperly manned, in the sense that her master or other officers are not properly certificated this may work to the disadvantage of the ship owner and could reflect seriously on the question of the seaworthiness of the vessel. In collision situations the question of proper shiphandling and navigation are invariably the paramount issues. Lack of a proper certificate is a statutory violation and casts doubt on the qualifications of the navigators.

Insofar as two vessels in collision are concerned, fault may lie with either or both. If liability attaches to only one all damages caused by the collision would extend to it. If it is established that the collision arose as a result of mutual fault, then under the divided damage rule all damage proximately caused by the collision would be shared equally. Obviously such damage could be very extensive should a nuclear catastrophe be the end result of a collision, and conceivably, if the right of the owner to limit liability is granted by the Court, upon proper petition being made, no fund, or a negligible fund, would be available for payment of damage.

THERE ARE MANY facets of the problem from a lawyer's standpoint. An article such as this can serve only to stimulate thought and emphasize the challenge presented. It is, of course, evident that the Government must more and more interject itself into the matter of indemnification and provide funds for claim settlements. The Marine Underwriters will surely carry their share of the burden but of course only within the limit of their capacity to do so.

INTERNATIONAL OPERATIONAL REGULATIONS and THE NUCLEAR-POWERED SHIP

By LCDR WILLIAM R. ST GEORGE, USN*

THE HARNESSING OF the atom has been proceeding at an astounding pace and its application to the transport of passengers and goods at sea is rapidly becoming a reality. All nuclear-power deliberations to date on an international level have concerned themselves primarily with the problems arising from the relatively confined use of reactors on shore where weight is of no special concern and it is possible to employ unlimited safety devices. The application of the reactor to the propulsion of naval submarines and its logical extension to surface craft, both naval and commercial,[1] have created a completely new set of problems for the lawyer in regulating the use of this new source of power.

International concern in the field of nuclear usages has been evident in International Conferences although not particularly related directly to the problem of nautical applications. Such concern was evident in deliberations over waste disposal at the recent International Conference on the Law of the Sea.[2] The Maritime Administration in this country has been most active in planning for the operation of SAVANNAH.[3] Yet to date there has been no direct international consideration of the problems relating specifically to the nuclear-propelled vessel. Such an opportunity will be offered in the spring of 1960 when there will be held in London an International Conference on the Safety of Life at Sea.[4]

This conference, as have previous Safety of Life at Sea Conferences, will have as its purpose common international agreement on uniform principles and rules promoting safety of life at sea. Included in its deliberations will be review of the construction standards of ships with particular regard for the prevention or mitigation of casualties. Also studied will be the requirements as to lifesaving appliances and emergency musters and drills. Additional consideration will be given to regulation of radiotelegraphy and radiotelephony at sea. The general field of safety of navigation is included and covers emergency and preventative safety measures relating principally to matters of operational nature. This field also includes the International Regulations for Preventing Collisions at Sea, the Rules of the Road, which although a separate document, were drafted by the Safety of Life at Sea Convention. An additional technical area lies in the carriage of grain and dangerous cargoes. It is not too difficult to envision the application of nuclear propulsion to all of these areas and to anticipate the marriage of the technical and the operational which will be so necessary to ensure maximum safety.

THE FIRST PROBLEMS to be faced by the 1960 Conference will undoubtedly be the proper means to write nuclear regulations into the present convention.[5] The first alternative is to incorporate nuclear requirements into the present framework of the convention. This solution, however, has the difficulty that there are areas such as port controls and waste disposal

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1. The Navy is building the USS LONG BEACH (CLGN 9) while the Maritime Administration on 22 May, 1958, laid the keel for the SAVANNAH, the first commercial nuclear ship. For discussion of naval activity in the field see Article, Nuclear Power for the Navy, by Craig Hosmer, USNR, Naval Institute Proceedings.
2. For discussion of this Conference see the Article *Radioactive Waste Disposal* Mobility and Freedom for Nuclear Seapower by LCDR J. H. Doyle in this issue.
3. See MARINE NEWS Vol. XLV No. 5, November 1958 for discussion of problems arising out of SAVANNAH plans.
4. For present convention in Force see Department of State Pub. 3282, International Organization and Conference Series I, 6. (International Conference on Safety of Life at Sea, April 23–June 10, 1948).
5. In the 1948 Convention on Safety of Life at Sea it was decided to write an annex on the Rules of the Road subject to adoption separately from the remainder of the Convention.

that are peculiar to nuclear operations and are not now covered by SOLAS. An alternative solution would be to add a new chapter to the present convention devoted exclusively to nuclear propulsion. This is a legal problem to which the solution will become more evident as the needs for regulation are developed in preconference work.

In the field of safety of design and construction of nuclear vessels procedures will have to be established to insure general international acceptance of nuclear vessels. Nations planning nuclear operations will have to institute procedures requiring their nuclear ships to meet safety standards both as to reactor and ship design. The risk of having an unsafe nuclear vessel either in design or construction operating on the high seas is not an acceptable one. Further the entire construction chapter of SOLAS, Chapter II, will have to be reviewed in its application to nuclear ships with a view toward determining whether the standards are sufficiently high for the nuclear vessel.

An additional area of concern to the nuclear committee of SOLAS is the question of manning and training of crews and also their protection. The present regulation on manning intentionally are broad and basically leave to each nation the control of its own manning standards on its own ships. The question then arises as to whether nuclear propulsion poses such a threat as to require more stringent definite manning requirements written into the International Regulations. This also raised the problem of the interrelation between the technical conference on Safety of Life at Sea and the appropriate international labor agencies and agreements. Nuclear power certainly raises some extremely difficult problems in this area.

Still another area of concern arising from nuclear propulsion is that of the operation and control in ports and close waters of the world. This subject is covered in another article of this issue.[6]

IT IS IN the area of the Rules of the Road, however, that there is the most direct and real interest to the Navy in its operations of nuclear ships. While the 1948 Convention on Safety of Life at Sea was a treaty ratified by the Senate,[7] the Rules of the Road annex was written into the statutes of this country, being passed by both Houses of the Congress.[8] Rule 1 of the Rules of the Road [9] requires that they be followed by all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels except as provided by Inland Waters regulations. Further the enacting clause of the statutory authority in this country [10] provides that they shall be followed by all public and private vessels of the United States. Thus both national and international intent to have these rules followed by *all* ships is clear. It is submitted that accordingly any revisions to the Rules of the Road expressly for nuclear ships will have a direct effect on naval nuclear operations. What then should be done in the area of the Rules of the Road to render maximum safety of operation for nuclear ships and what changes are necessary in the present Rules of the Road to insure against the occurrence of a major maritime nuclear incident through collision? In developing change recommendations it should be emphasized that the promotion of safety at sea through improved Rules of the Road is a real need for all ships at sea and is not confined to the problems and dangers created by the new source of nuclear power.

It can and has been argued that no change is necessary in the Rules of the Road on the basis that if properly followed the Rules are collision proof. Advocates of this reasoning would reduce all collision to the human factor violation of the Rules of the Road. While there is some merit to this contention, the inescapable fact remains that despite technological advances, such as radar, collisions resulting in loss of life and property at sea continue to occur.[11] It is submitted that these are not all attributable to human failing and that improvements in the Rules of the Road are needed.

The first area of suggested improvement is directed toward the human failing. It is submitted that the maritime industry as a whole, the Navy, as well as the growing millions of pleasure boat operators,[12] must be made more conscious of the promotion of safety through proper application of the Rules of the Road. It

6. See *The Atom at Sea* by Captain L. R. Hardy, USN.
7. Safety of Life at Sea Convention was proclaimed by the President on Sept. 10, 1952, to come into force on Nov. 19, 1952. The Regulations for Preventing Collisions at Sea, 1948, were proclaimed by the President on Aug. 19, 1953, to become effective on 1 January 1954.
8. 33 USC 143–147d, 65 Stat. 406–420.
9. 33 USC 144.
10. 33 USC 143.
11. For figures on fiscal year ending 30 June 1958 casualties see Proceedings of Merchant Marine Council, Vol. 16 No. 1, January 1959, p. 19.
12. As of 30 Sept. 1958, there were 477,556 undocumented small vessels owned in the United States and found on the navigable waters thereof. For details see Proceedings of the Merchant Marine Council, Vol. 15 No. 12, December 1958, p. 233. During fiscal year ending 30 June 1958, there were 266 fatal boating accidents reported to and investigated by the Coast Guard with 375 fatalities. Proceedings of the Merchant Marine Council, Vol. 15 No. 12, December 1958, p. 235.

will certainly be incumbent upon the operator of a nuclear ship to ensure that his navigation personnel are thoroughly familiar with the Rules of the Road by providing for proper indoctrination and constant review. Thorough understanding of all aids to navigation of the nuclear ship, such as radar, is an absolute must. Thus, it is incumbent on the Navy to ensure the absolute maximum in safe navigation on the nuclear ship with the same emphasis that is placed on the safe operation of the reactor. No lack of knowledge of the Rules of the Road and their proper application in avoiding collisions should be tolerated.

Looking beyond these obvious personnel applications, what areas of the Rules of the Road are subject to improvement? The first, and perhaps major, contributor to serious collision at sea is the improper maneuvering under Part C of the Rules of the Road, the so-called Steering and Sailing Rules.[13] There is no basic confusion engendered by these rules as to the basic rights and responsibilities between two vessels. A vessel is required to either yield or hold on when approaching another vessel according to the locations of the two vessels in respect to one another. When the vessels come into close proximity, however, whether through violation of a rule or not, Rule 21,[14] the Course and Speed Rule, by its working presents a major dilemma to the man on the bridge. This rule requires the vessel which has the right of way to hold course and speed. This burden is imposed to a point wherein this holding-on vessel is so close that collision cannot be avoided by the action of the giving-way vessel alone. This magic moment is best known in the courts as "extremis" and its determination, after an extremely difficult waiting period, is the most dammed single provision of the Rules. What naval sea-going officer has not had the opportunity of being privileged to hold-on until he has reached the X-marked spot where complementary action must be taken to avoid collision, particularly when such complementary action must be based on the previously unmoving giving-way vessel giving way. One can only hope that some means can be found to require more positive action by the giving-way vessel. Certainly it is questionable whether a nuclear powered vessel should ever permit itself to be placed in the position of holding on to the critical "in extremis" point.

A collateral problem to that of maneuvering is that of proper notice of maneuvers in adequate time to permit compliance with the Rules of the Road. Unfortunately in all too many collision cases, testimony has revealed that despite recognition of a potentially dangerous situation, both vessels have steamed into the very jaws of collision relying upon the erroneous hearing of a whistle signal or a complete failure to hear the signal. This is not an uncommon occurrence in a high wind condition with a lack of any visual indication of the sounding of the whistle. An immediate solution to this problem is the requirement of a light to be synchronized with the whistle. Such a light is now required on the Western Rivers of this country and is in general use on the Great Lakes. It is also under active consideration by the National Subcommittee on the Rules of the Road preparing for the 1960 Conference.

Beyond this immediate solution, however, lies the fact that complete understanding between two ships maneuvering in close proximity to each other can only be provided by exact knowledge by each of the intentions of the other. The bridge-to-bridge short range radio-telephone combined with properly used radar could provide a solution to this problem. Unfortunately this system is plagued by several practical problems, namely language difficulties, identification, cost and general applicability. At the recommendation of the House Committee on Merchant Marine and Fisheries, this proposal is under active consideration in this country. It is hoped that the modern application of voice radio-telephone will be available to assist the nuclear ship in its safe operations at sea.

A third and potentially the most dangerous is the condition of reduced visibility, covered by Rule 15, Sound Signals, and Rule 16, Speed in Fog. It is to this problem that the use of radar is best directed and in which its use is most condemned. Such condemnation is not completely surprising, however, for radar has given birth to the practice of excessive speed in fog in reliance of this piercer of the fog veil. As the underwriters have discovered to their financial regret the radar-assisted collision has become a very real reduced-visibility risk. It now appears that a radar code of conduct will receive serious consideration in the 1960 revisions of the Rules of the Road. Collateral to this problem is that of the small craft which provides an extremely poor radar target. Under active consideration, although more of a ship equipment problem than one of the Road to the Rules, is the requirement that such vessels carry a radar reflector when operating on the

13. 33 USC 146–147k.
14. 33 USC 146e.

high seas. With the introduction of effective radar applications in the Rules of the Road, a realistic provision for speed in a fog should become a reality. Certainly a nuclear powered ship must operate extremely cautiously in reduced visibility and must not only be equipped with the most effective radar but also must maintain a high standard of operating efficiency for that equipment.

AN ADDITIONAL AREA of possible improvement lies in the field of navigational lights which at night provide essential information not only as to the location of the other vessel but also as to what she is doing. It is surprising to note that after seventy years of operation of the International Rules of the Road, visibility of running lights required by Rule 2 are still the original five miles for the white lights and two miles for the colored side lights. These were based on visibilities of oil fired lamps but it should be noted that even with electrical lights the ranges obtainable are not much in excess of these. This is particularly true in relation to the colored side lights. Even more curiously the standards of visibility, as defined in Rule 1, require that visibility shall be based on a dark night with a clear atmosphere. This poses to the technician, particularly the inspector of lights, a difficult problem as to precisely what standards should be required. This problem is being attacked by technicians assisting the National Rules of the Road Subcommittee looking forward to the establishment of some definitive technical standard of measurement to be applied in determining the effectiveness of navigational lights. Following the development of this standard, however, the problem of increasing the range at which the lights can be seen will still remain. It appears from preliminary studies that with present light sources the present ranges of visibility are relatively close to the maximums available. Increases in power supply to the lights result in only minor increases in range. Thus the development of new light sources such as pressure gas discharge lamps, the compact arc mercury or xenon lamps, are suggested. Further technical study is definitely indicated.

Collateral to this problem is the need for the navigational light to function initially as an attention gathering device. Everyone should be familiar with the modern land applications of flashing lights and their use in alerting approaching persons to danger. The application of these principals particularly to side lights has been suggested and is under active consideration by the National Rules of the Road Subcommittee.

It is well realized that the above recommendations for improvement in the Rules of the Road are conducive to the increased safety at sea for all ships. It is submitted, however, that the operations of the nuclear ships have emphasized the need for this improvement giving credulance to the opinion that another ANDREA DORIA-STOCKHOLM collision cannot be permitted to happen.

THE ABOVE COMMENTS and recommendations cover an extremely broad area of maritime technical endeavor much of which will clearly not be susceptable of international acceptance in the relatively short period of eight weeks allotted to the 1960 Conference on Safety of Life at Sea. When one considers that present plans call for the first nuclear merchant ship, the SAVANNAH, to become operational at about the time of the convening of this convention, the immediate need for sweeping improvement is not apparent. If, as in the past, revision of SOLAS and the Rules of the Road relied upon *ad hoc* conferences at intervals of twelve or more years there would be some urgency in these deliberations. The recently ratified Intergovernmental Maritime Consultative Organization (IMCO),[25] however, will upon conclusion of the 1960 Conference accept cognizance of this field. This body has provision for routine consideration of recommendations for improvement by its Maritime Safety Committee, a working group which meets annually or on call. Regular biannual meetings of the Counsel and the Assembly would then process changes in an orderly fashion and as nuclear operations progress, creating problems as they go, the International Regulations will be able to keep pace with this progress. Of course this body will work closely with the International Atomic Agencies.

The introduction of nuclear power to nautical propulsion does raise new problems in the area of safety at sea. New ideas, legal, technical and operational, are urgently needed to assist in solving these problems and as the sole operator of nuclear ships at this time the Navy should properly assume a position of leadership in this field. It is only by a studied reasoned approach to these problems that maximum realization of nuclear capabilities can be obtained. The Navy's law firm has a very real service to render its client, the Navy, in providing legal guidance through the pitfall of nuclear-power regulation.

(*Continued from page 11*)

capital on a ship which he cannot be sure will be able to participate in ocean commerce. He must be certain, even before the ship is laid down, that she will be able to carry on the normal commercial activities of a merchant ship.

ALL OF THE above is of particular importance to any American lawyer who has the opportunity to participate in the formulation of international law. The United States was the first nation in the world to demonstrate the use of nuclear power for peaceful purposes and the first to put nuclear power to work propelling ships. The world's first nuclear powered merchant ship, the SAVANNAH, is now being built in an American yard and will commence operations during 1960. She will be followed shortly by other nuclear powered ships of our merchant marine fleet. The United States must, therefore, assume the leadership in the field of proper yet not irrational or unduly restrictive regulation of such ships. If the SAVANNAH is to become a Flying Dutchman—doomed to sail the seas forever without ever making port—she will be the first and *last* of her class.

Not even the most elementary inquiry into the legal questions raised by the operation of nuclear powered ships (as this one is), would be complete without some mention of nuclear powered naval ships and various aspects of operations which are peculiar to them. At the present time, the whole of the world's experience in operating such ships is vested in the United States. In addition, by domestic law and regulation, naval power reactors, unlike shore based commercial reactors which must be licensed by the Atomic Energy Commission, are the sole responsibility of the United States Navy. The gravity of that responsibility is well recognized by the Navy. Its ships are inspected with great care and technological skill at every stage of their design and construction. Their crews are especially trained and operate their ships under the most exacting standards. The histories of our nuclear powered submarines bear excellent witness to the Navy's competence and skill in this field.

TO MAINTAIN THIS degree of skill and competence is most important because our Navy ships, like most people, live or die by their reputation. Being warships, they cannot be laid bare to public or foreign governmental scrutiny as is suggested above for merchant ships. They must be accepted, if they are to be accepted at all, solely on the basis of their reputation as safe ships and on confidence in the Navy which built and operates them. That confidence was displayed in the invitations for our nuclear powered submarines to visit ports of Norway, Belgium, Holland, France and the United Kingdom. There was not, however, sufficient confidence in those ships in the case of the planned visit of the SKATE to Denmark. The Danish government could not be furnished with sufficient information on which it could base its own independent determination that the ship would not endanger the Danish people. If the responsible officers in the government were not so convinced, they would naturally be expected to give primary consideration to the safety of their people. We would expect our own government to do the same thing if a foreign nuclear powered warship were to request permission to enter an American port. The Danish government should not, therefore, be criticized for its decision not to invite the SKATE.

The Navy should continue to operate its nuclear powered submarines in substantially the same manner as it operates conventional powered ships in order to convince all people and governments that they are justified in relying on the good reputation of such ships. When they are so convinced, we can be certain that all of the nations which welcome the good will visits of the ships of the United States Navy will also welcome our nuclear powered ships.

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importance of increasing our efforts to solve some of these complex legal questions upon which I have briefly touched.

CONCLUSIONS

THE ATOMIC AGE will bring many new and fascinating problems. Perhaps one of the thorniest will be that of third party liability in the remote event of an accident involving a nuclear-powered ship, permitting release of radioactive materials from the reactor. This problem has received little study to date partly because of the excellent operating safety record of the Navy and the AEC, and partly because all ships to date are Government owned. However, the day of widespread commercial application of nuclear propulsion is not far distant, probably within 25 years.

The United States Congress, through passage of the Price-Anderson Act in 1957 and its extension to the NS SAVANNAH in 1958, has

closely studied nuclear liability problems and has enacted a satisfactory statutory solution for land based power reactors in the USA, and for the SAVANNAH. Corresponding progress has not yet been made in other countries, although the U.K. has considered in 1959 a nuclear liability bill, and the OEEC has proposed a draft convention to its 13-member states. Neither of these developments abroad, however, provide any governmental indemnity similar to the $500,000,000 provided by the Congress for reactors in the United States and the NS SAVANNAH.

In approaching liability problems of nuclear-powered ships, a clear distinction should be made between naval ships and privately owned maritime ships. Visits of Government owned U.S. Navy ships to foreign ports can probably be arranged on an individual country-to-country basis, but privately owned merchant ships should meet standards, preferably as established by the International Atomic Energy Agency or an international convention. An international convention providing standards for maritime ships should be realistic, and should be negotiated with other countries which may own or operate nuclear-powered ships in the foreseeable future, and should not be unnecessarily restrictive upon the operations of such ships.

Some of our traditional maritime legal rules such as a low limitation of liability of the shipowner, will probably have to be modified in order to provide adequate protection to the public.

The legal problems associated with operation of nuclear-powered ships deserve more attention. The Navy has led the way in nuclear propulsion, and lawyers in the Navy are particularly well qualified to make valuable contributions in this new field.

WASTE DISPOSAL

(*Continued from page 16*)

izing its case for *controlled* disposal of radioactive waste to the seas.[28]

The policies and practices of the users of nuclear power will have great weight in the deliberations of the IAEA. Let us take a quick look at a few of those established by this country in this field of the disposal of radioactive wastes to the seas.

POLICIES AND PRACTICES

IN DISCHARGING ITS responsibility to regulate and license private atomic energy activities so as to protect public health and safety, the Atomic Energy Commission has developed and placed into effect a comprehensive system of regulations.[29] The standards for protection against radiation establish permissible concentrations in effluents to unrestricted areas. They also provide for the disposal of only minimal quantities of nuisance waste by release into sanitary sewage systems and by burial in the soil, or on a routine basis.[30] Normally, licensees

28. On the question of evaluating judgments based on inconclusive scientific findings, it is significant to note that the USSR and Czechoslovakia members submitted a substitute paragraph 54 to the recent Report of the United Nations Scientific Committee on the Effects of Atomic Radiation, which read, in part, as follows:

"... The physical and biological data presented in the report make it plain that efforts should be made to eliminate the uncontrolled source of radiation, i.e., to end experimental nuclear and thermonuclear explosions, and enable the Committee to draw the conclusion that there should be an immediate cessation of test explosions of nuclear weapons." General Assembly, official records: 13th Session Supp. No. 17 (A/3838), p. 41.

The report, of course, supported no such conclusion and fortunately this proposal was rejected. (Czechoslovakia, USSR, UAR voted for; Belgium and India abstained). In fact, the Committee specifically reported that "any present attempt to evaluate the effects of sources of radiation to which the world population is exposed can produce only tentative estimates with wide margins of uncertainty." Id. at p. 42.

In this connection, it might be well to remember that the Sino-Soviet bloc land mass is over 4½ times the area of the United States.

As in the case of nuclear testing, the Soviets stand to gain by securing an international ban on the disposal of radioactive waste to the oceans of the world, which comprise 71% of the earth's surface.

29. For a detailed report on licensing activities, see statement of Mr. H. L. Price, Director, Division of Licensing and Regulations, AEC, entitled "Activities of Federal and State Agencies in Regulating Disposal of Radioactive Waste—The Atomic Energy Commission's Regulatory Program," HEARINGS.

30. 10 CFR 20. For a detailed account of U.S. disposal operations at sea up through 1956, see "United States' Sea Disposal Operations—A Summary to December 1956" by Arnold B. Joseph, Sanitary Engineer, Reactor Development Division, AEC, WASH-734, AEC. This report includes a description of the packaging used and the location of the dumping areas.

cannot take advantage of environmental dilution unless, by application to the AEC for higher limits, it can be shown that after dilution with environmental media it is unlikely that any individual will be exposed to concentrations in excess of permissible limits. Through licensing and inspection, the Commission provides reasonable assurance that the standards established protect the public health. Two general precepts for the protection of man and his environment in their ecological associations have been followed by the AEC. They are: "with high level radioactive wastes, concentrate and contain; [31] with low and intermediate level radioactive wastes, dilute and disperse to nature".[32]

The various methods of disposal include:

1. Disposal by sewer or burial in the soil.
2. Return to the AEC.
3. Disposal at sea.
4. Treatment by incineration.
5. Transfer to commercial disposal firms.

With regard to the issuance of licenses authorizing disposal at sea, the recommendations of the National Committee on Radiation Protection and Measurements (published in the National Bureau of Standards Handbook 58) are generally followed by the AEC. In this connection, the International Committee on Radiation Protection is due to make a report on the overall waste disposal problem this year. They have not yet attempted to establish specific levels for permissible radioactive contamination. However, it is reported that they have "already clearly enunciated the proposal that waste disposal levels should be such that no individual is likely to receive radiation exposure in excess of one-tenth of that allowed for controlled radiation workers".[33]

In issuing licenses for disposal at sea, the criteria generally followed by the AEC are that the waste (1) shall be disposed of in a minimum of 1,000 fathoms of water, and (2) shall be packaged in such a manner that under the conditions of handling and shipment the package cannot be easily damaged or broken and will reach the ocean bottom without appreciable loss of contents. The package must have sufficient density to insure sinking to the ocean bottom and must have sufficient shielding to allow safe handling. It must be appropriately labeled and conform to applicable shipping regulations of the ICC and Coast Guard, in addition to the conditions of the license.

WITH REGARD TO radioactive waste from U.S. Naval nuclear powered ships, the basic criterion adopted is that disposal should not increase the average concentrations of radionuclides in the surrounding environment by more than one-tenth of the maximum permissible concentrations for continuous exposure listed in National Bureau of Standards Handbook 52. Actual data from the operating ships shows that the radioactivity of their wastes *is consistently low and has had no detectable effect on the radioactivity of their environment.*

This conclusion is supported by a comprehensive study and analysis of operating naval nuclear reactors and prototypes.[34] This study includes a complete identification of the fission products [35] and radionuclides [36] found in the reactor coolant, and the radionuclides found in the ion exchange resin and the reactor shield

31. All high level waste resulting from processing of spent fuel elements from licensed reactors is being returned to the AEC for processing and handling. See Price, note 29 supra.
32. Wolman, The Nature and Extent of Radioactive Waste Disposal Problems, HEARINGS. He reports that in 1958, approximately 10^9 gallons of low level liquid wastes have been discharged on a rigidly controlled, quantitatively monitored basis, after various forms of treatment ranging from orthodox waste treatment processes, such as coagulation and settling, to evaporation.
33. See report on the work of the International Commission on Radiological Protection by Dr. Lauriston S. Taylor, Chief of Atomic and Radiation Physics Division, National Bureau of Standards, and also Member, International Commission on Radiological Protection, HEARINGS. The ICRP was formed in 1928. At the present time with its subcommittees its membership includes some 75 specialists in the radiation field drawn from about 15 countries. It has a working relationship with other governments analogous to the World Health Organization.
34. See report submitted by Nuclear Propulsion Division, BuShips, HEARINGS, from which was taken the information that follows on nuclear naval ships.
35. For example, the following determinations have been made with regard to concentrations of fission products in reactor coolant.

TABLE II.—Concentrations of Fission Products in Reactor Coolant

Nuclide	*Half Life*	*Concentration, μc/cc*	*Dumping Tolerance, μc/cc*
total iodine	variable	5×10^{-4}	to be conservative 1×10^{-8} is normally used.
I^{131}	8 days	1×10^{-3}	3×10^{-9}.
total strontium	variable	5×10^{-4}	to be conservative 1×10^{-7} is normally used.
Sr^{90}	28 years	5×10^{-4}	8×10^{-8}.
Sr^{89}	54 years	5×10^{-6}	7×10^{-9}.
Ba^{140}	13 days	1×10^{-6}	2×10^{-1}.
Ce^{144}	285 days	1×10^{-7}	4.0.
Cs^{137}	30 years	1×10^{-6}	1.5×10^{-1}.

Identifications have also been made with regard to other sources of radioactive waste in naval nuclear powered ships. See tables in report by Nuclear Propulsion Div., BUSHIPS, HEARINGS.

36. It is significant that as a result of detailed analyses of the NAUTILUS reactor coolant made every 1 to 2 months during the operation of the first core, and at less frequent intervals for the second core, no new nuclides appeared. The gross 15 minute activity has remained below a normal operating limit of 0.3 microcuries per cubic centimeter (μc/cc). Similar results have been obtained for the SKATE and other naval reactors already operating.

water,[37] with their respective concentrations and activity. As a result, shipboard control procedures have been developed. In general, these procedures provide that for discharge of reactor coolant and other effluents containing reactor coolant in port or restricted waters, the reactor coolant gross activity must be less than 3 uc/cc (unless the reactor has been shut down for 48 hours or more), and the fission product iodine^{131} and fission product strontium^{90} must be below 10^{-3} uc/cc and 10^{-4} uc/cc, respectively. For discharge in the open sea, no restriction is specified since the quantities of waste are small, the activities are normally well below the dumping tolerances,[38] and the dilution obtained is much greater.

As to the disposal of the ion exchange resin, if replacement is necessary in port, the resin is dumped to a disposable catch tank.[39] Resin discharge at sea can take account of the great dilution available in the ocean. Thus, such discharge is permitted with due regard to land, other ships and fishing areas.[40] Since the concentrations in reactor shield water are well below dumping tolerance, no waste disposal restrictions for radioactivity are necessary in this regard. Solid wastes are transmitted ashore for appropriate packaging and disposal. The infrequent liquid wastes resulting from decontamination of radioactive tools and equipment and laundering of radioactive anti-contamination clothing are handled in the same manner as the radionuclides in the reactor coolant water (they contain the same radionuclides).

Surveys are being conducted in cooperation with the U.S. Public Health Service[41] to verify the adequacy of these waste disposal procedures. Included in the surveys are measurements of the radioactivity of water and atmospheric fallout, and, at times, of marine organisms, fish, shellfish, mud, and vegetation. The greatest amount of experience with these surveys to date has been obtained in the New London, Conn. area. An analysis of the data recorded shows that the only increases in the activity of the river water samples *occurred during periods when nuclear weapons fallout was detected in rain and snow samples.* These increases bare no relation to the operation of nuclear submarines. It must be concluded from this survey that the controlled disposal of radioactive wastes from the NAUTILUS and SKATE has had no detectable effect on the radioactivity of the environment.[42]

37. Small concentrations of radionuclides are produced by neutron activation of the potassium chromate ($^2/_{10}$ of 1%) is used as a corrosion inhibitor) and impurities in the shield water.

38. The following is pertinent in the establishment of shipboard control procedures:

1. A dilution factor is first determined by considering the frequency and quantities of coolant that are discharged and the dilution factors that are available in harbor waters. It has been established that in these waters a dumping tolerance of 100 times the NBS Handbook 52 tolerance for any specific nuclide is conservative. (By actual measurements, it has been shown that the actual dilution factor is at least 100,000).
2. By equally scaling up the activities of all the individual nuclides until the first nuclide reaches its dumping tolerance, it is determined that when the gross coolant activity is 3 μc/cc all nuclides are below their respective dumping tolerances. This gross activity then becomes the shipboard limit for disposal of reactor coolant during operation. (In actual experience this gross activity is nearly always 0.3 μc/cc.)
3. A similar scale-up is performed for the coolant after reactor shutdown. This condition is different from the operating condition above since all short-lived nuclides in the reactor coolant have decayed. This gross activity limit becomes 0.1 μc/cc for this case. (Iron^{59} comes closest to dumping tolerance and its highest concentration in the coolant more than 48 hours after shutdown is less than 10 percent of the gross activity.)
4. For the unexpected condition where fission product concentrations might become significant, the fission product that is closest to dumping tolerance is determined. A shipboard radiochemical procedure is established for determination of this nuclide. Experience on all naval ships to date indicates that the worst nuclide is iodine^{131} with a dumping tolerance of 3×10^{-3} μc/cc. (A radiochemical analysis for iodine is performed daily to determine that iodine^{131} concentration is below 10^{-3} μc/cc. This insures all other fission products are below their respective dumping tolerances.)

39. The tank is subsequently sealed and buried by land or sea in accordance with approved AEC instructions.

40. When dumped overboard the resin will sink and as it sinks the radioactive ions on the resin are rapidly replaced by ions of the sea water. Thus, within a few minutes the radioactivity has transferred from the resin to the sea water in the wake of the ship where it will rapidly disperse.

Assuming conservatively that the wake is no longer than the path of the ship itself, the distributed activity from the resin results in a sea water gross concentration in the ship's wake of less than 10^{-3} μc/cc. Even at this concentration, all nuclides are below NBS Handbook 52 permissible concentrations.

Mention should be made of a gaseous radionuclide that may be found in the reactor coolant—argon^{41}. It may reach concentrations up to 0.7 μc/cc. It has a short half-life (1.9 hours) and since gaseous, will mostly escape to the atmosphere upon discharge. It is not an ingestion hazard, and calculations have shown that if all the argon^{41} in the coolant were released as a cloud, persons exposed to the cloud would receive only a negligible external radiation dose. Thus, it presents no waste disposal problem to naval nuclear powered ships.

41. For a report on the overall responsibilities and activities of the Public Health Service, see report of Dr. David E. Price, Chief, Bureau of State Services, Public Health Service, Activities of the Public Health Service Relating to Radioactive Wastes, HEARINGS.

42. See tables compiled in report by Nuclear Propulsion Division, BuShips, HEARINGS. No discussion would be complete without mention of the waste disposal system planned for the SAVANNAH. The basic design is predicated on complete retention of all liquid and solid wastes associated with the reactor plant. Liquid wastes normally will be accommodated by a series of storage tanks totalling *1,320 cubic feet.* For a complete report see Waste Disposal Considerations in the Nuclear Powered Ship Program, Maritime Administration, HEARINGS. Maritime readily admits that collection and storage of all reactor plant wastes aboard ship imposes an additional penalty in terms of cost, weight, and cargo at the expense of potential cargo capacity, and considers it desirable that future commercial nuclear ship design be predicated on the basis of controlled disposal of radioactive wastes to the open sea. Of course, provision for containment of wastes in this prototype merchant ship will be helpful in future studies of the problem, but such a system would appear to be entirely unacceptable for any naval nuclear powered ship considering factors of space, weight, length, speed and *mission.*

CONCLUSIONS

IN THE EXPLORATION and exploitation of the seas, we are in the stage of infancy.[43] Despite all the scientific and technical competence being applied, the fact must not be overlooked that a vast research effort remains.[44] We must continue our search for vital knowledge concerning 71% of the earth's surface.[45]

However, our present state of oceanographic knowledge does not preclude an assessment of our procedures in the field of radioactive waste disposal as a matter of international law and policy. From an examination of our practices and policies, it is concluded that the controlled disposal of radioactive wastes to the seas does not "adversely affect man and his marine resources." [46] The test of *reasonableness* has been met. Our present activities in this field are in full conformance with international law.[47]

The Geneva Conference on the Law of the Sea has again demonstrated that attempts by the Soviet bloc to discredit the activities of the free world in this field cannot be underestimated. Nor can we underestimate the impact of Communist generated propaganda on many nations of the world.[48] Nor, for that matter, should we overlook a basic Communist technique in their goal of world domination—the use of international negotiations and agreements as a vehicle to secure concessions which weaken the free world.[49] Premier Khrushchev recognizes full well that in the seapower of the free world lies its strength.[50] To immobilize our naval power is a Communist objective. By successfully exploiting mankind's fears in this unfamiliar field of radioactive waste disposal, the Communists could seriously weaken the capabilities of our naval nuclear forces.

On the other hand, we cannot ignore the genuine anxieties of certain nations on this question. To do so would be disastrous.

We must be prepared to meet both challenges in forthcoming international deliberations. We can do this by marshalling and presenting the facts, confident that we are acting under international law.

The problem of radioactive waste disposal to the seas is more than a technical one. It is the concern of the naval officer as well as the statesman, lawyer, scientist and health officer—for it is the nuclear powered naval ships that sail free high seas. And some day it may be nuclear powered naval aircraft that will overfly them. Naval officers can do much in their role of diplomat and specialist in international relations to combat the Communist challenge and dispel the doubts on this subject that exist in some of the capitals of the world. As in the case of most unknowns, education does much to remove the fears. Naval officers are in a unique position to assist in this task.

With education and the development of the facts, a sound basis can be provided for the establishment of acceptable international standards and realistic international law.

43. A committee of the National Academy of Sciences recently urged that the United States must substantially expand oceanographic research to avoid being placed in a "precarious position" in the exploration and exploitation of the seas. N.Y. Times, 16 Feb 1959, p. 1, col. 2.

44. For a determination of the effects of radioactive waste disposal upon the oceans and the life therein, the Committee recommended studies be conducted of,

(1) Dispersion of these contaminants by circulation, mixing, and settling out.

(2) Dispersion and distribution of atomic wastes by living marine organisms and the genetic effects of the radiation on marine life. Wash. Post, 16 Feb 1959, p. 10, col. 3. One area we specifically need to know more about is the uptake and retention of radioactive elements by marine organisms. See Revelle and Schaefer, General Considerations Concerning the Ocean as a Receptacle for Artificially Radioactive Materials, Nat. Academy Sciences Pub. 551 (1957), The Effects of Atomic Radiation on Oceanography and Fisheries.

45. Throughout the report of the National Academy of Sciences ran an evident concern that the Government and the scientific community were becoming so intent on exploring the new frontier of space that they were forgetting the vast unexplored regions of the seas on earth. "We know less about many regions of the oceans today than we know about the lunar surface." N.Y. Times, 16 Feb 1959, p. 1, col. 2. They warned also of the Soviet's growing oceanographic fleet.

46. The reports of the National Academy of Sciences—National Research Council in both 1956 and 1957 state in part:

"Tests of atomic weapons can be carried out over or in the sea in selected localities without serious loss to fisheries if the planning and execution of the tests are based on adequate knowledge of the biological regime. *The same is true of experimental introduction of fission products into the sea for scientific and engineering purposes.*" (Emphasis supplied.) See NAS Pub. 551 at p. 23, *supra* note 74.

47. This is not to imply that our practices may not vary as our knowledge increases so as to meet this test of reasonableness.

48. The false accusation by the Chinese Communists regarding germ warfare during the Korean war is a good illustration.

49. For an analysis of this aspect in relation to space law, see "Space Law as a Way to World Peace", RADM. Chester Ward, USN, JAG Journal, Feb. 1959, p. 10.

50. In his letter of 7 Sept 1958, to President Eisenhower, Khrushchev revealingly complained:

"In connection with the practice of transporting war fleets and air units from one end of the globe to another . . . in order to bring pressure to bear here on some, there on other states and to attempt to dictate one's will on them, in general the question arises—isn't it time to finish with such actions which, it goes without saying, can in no way ever be recognized as normal methods in international relations. There arises the legitimate question—ought this not be discussed in the UN and a decision be adopted *forbidding powers from employing such movement of its naval and air forces . . .* and *to the effect that these forces would be held within the limits of their national frontiers.*" (Emphasis supplied.)
39 Dept. State Bull. 500 (1958).

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